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The AGATE Flier

Information on developing technologies for business and personal transportation aircraft

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New Training Courses Accelerate Pilot Qualifications

A revolutionary series of flight training courses, known as the AGATE Flight Training Curricula, are helping prospective pilots to learn how to fly advanced general aviation (GA) aircraft in less time and at lower cost than traditional flight training courses. The Flight Training Curricula were developed by AGATE Curriculum Development Team member Jeppesen Sanderson and administered by Embry-Riddle Aeronautical University (ERAU), Daytona Beach, Florida. The curricula, part of the Flight Training Curriculum Work Package, are supported by NASA through the AGATE program and the FAA Flight Standards District Office, Orlando, Florida. In addition to offering students the opportunity to obtain their Private/Instrument certificate in one step with about a 25 percent reduction in cost and flight time, the curricula introduce students to AGATE-developed technologies designed to reduce workload and improve safety.

According to Dr. Steven Hampton, Principal Investigator for Embry-Riddle, significant progress is being made within the Flight Training Curricula Program. "The Flight Training Curriculum Work Package has three goals this year: (1) to establish a baseline against which further enhancements in training curricula can be measured, (2) to develop a Training Module for the Integrated Cockpit Information System (ICIS), and (3) to develop a Training Module for the Propulsion System Management Functions (PSM). At the present time, progress has been made towards the first two goals. Two curricula have been written: a Basic Curriculum modeled after the new FAR Part 141 regulatory requirements, and a Unified Curriculum that teaches instrument and private certificate skills in an integrated program."

The Basic Curriculum consists of Private training followed by Instrument training in a continuous program—students are taught all of the skills required for Private Pilot certification followed by skills required for Instrument training. The training follows established guidelines and meets all of the FAR Part 141 requirements. One difference is that a proficiency-based approach is used, instead of the traditional minimum time requirement.

Ray Wabler
AGATE Executive Council Member

"If we can successfully attract and efficiently train more pilots, the market for new aircraft will be expanded. The expansion of the market for new aircraft will result in greater economies of scale and lower prices for the aircraft."

The Unified Curriculum integrates Private and Instrument skill training from the beginning. Traditional training methods call for separate courses for separate ratings. The Unified Curriculum is intended to provide additional reinforcement of skills such as ADF Instrument Approaches. "Introduction of these types of activities early in training gives

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photo courtesy of Embry-Riddle Aeronautical University

AGATE Flight Training Instructor Jesse Rhodes (left) and AGATE Flight Training Student Eric Pedroza pose alongside an AGATE Flight Training Curricula Program C-172.

photo courtesy of Embry-Riddle Aeronautical University

A Personal Computer Aviation Training Device (PCATD) used for ground training in the Unified Curriculum.

From the desk of the Program Manager

Dr. Bruce J. Holmes, NASA Langley Research Center

A Preview of AGATE Legacies

"The tide raises all ships." This metaphor aptly describes general aviation revitalization. As we approach the end of the AGATE program in three short years, we will see (in some cases, are already seeing) the emergence of new and different kinds of industrial competitiveness on this "raised tide." The new competitiveness will be characterized by faster paced innovations, higher levels of performance, and lower cost, all with advancements in quality. AGATE's most important legacy will be the revitalized research and technology (R&T) capacity in the U.S. general aviation lightplane industry. This emerging R&T capacity is becoming world class in all disciplines, avionics, airframes, engines, and pilot training technologies. If the new R&T capacity is the "tide," then ***open systems*** will be the sails propelling the ships (companies) that sail with the tide.

Some AGATE legacies will be highly visible, others virtually invisible. Paradoxically, it is the less visible legacies, including the industry movement toward open systems, that will carry the more visible legacies to full fruition. What are open systems? What is the role of open systems in general aviation revitalization? What is the Government interest in open standards?

What are open systems? The U.S. DoD definition for open systems is: ". . .a business and engineering strategy to choose specifications and standards that are (1) adopted by industry standards bodies, or (2) *de facto* standards (set by the marketplace) for selected systems interfaces (both functional and physical), products, practices, and tools." Aircraft comprised of subsystems adhering to open systems, architectures, and protocol standards will achieve high levels of component integration and interoperability; in turn, several benefits accrue.

The benefits of open systems include access to COTS economies of scale, more rapid technology insertion, higher system performance, increased interoperability, and ultimately, improved competition. For example, general aviation will ride the coat tails of the PC revolution in both technology and cost. The ultimate beneficiary is the consumer. The challenges to open systems are significant. They include reduced vendor control, development of certification paths under the Federal Airworthiness Regulations (FAR), and ongoing standards management. AGATE is tackling these challenges through an industry consensus approach to standards. This approach is producing FAA advancements in certification reforms. These reforms include the new materials qualification process for composites and the revised FAA Advisory Circulars (23.1309 and 23.1322) for the revolutionary changes in cockpit systems. This approach also results in competitive product innovation in the marketplace. Open systems are all about better, faster, and cheaper.

Some open systems standards can be defined up front; clearly, others must await the vote of the consumer. AGATE focuses on those high level open systems capabilities that can be defined up front, using the industry consensus approach. There are clearly risks in attempting to choose standards. AGATE targets those standards that have the greatest likelihood of robustness for standing the test of time. We also seek standards that create pathways for expansion of performance in both hardware and software.

What is the role of open systems in general aviation revitalization? The industry movement toward open systems and protocol standards plays a key role in revitalization. The most visible AGATE legacy will be our "Highway in the Sky" operational capability. A "highway in the sky" is a graphically intuitive PFD depiction of a desired flightpath (either your VFR flight plan or IFR clearance) derived from the functions provided by the AGATE Architecture. This flightpath depiction resolves weather, traffic, terrain, and airspace issues for the pilot without the use of ATC voice communications. The ability to affordably deliver the "Highway in the Sky" concept to market depends vitally on open systems standards.

We plan to complete other equally vital legacies including simpler and safer engine management, more utility in weather (including icing conditions), more affordable and crashworthy composite airframes, and streamlined flight training. These legacies will appear as the most visible industry products and services.

The less visible paper products are taking the forms of RTCA and AGATE MOPS for CNS and cockpit information and display systems; design guidelines for crashworthiness and lightning protection; and industry standards for architecture and subsystems and components affecting engines, airframe, and avionics. These are the invisible legacies that enable the visible legacies to emerge.

The adoption of open systems philosophies and standards by the U.S. general aviation industry will open the door to the revolution in digital bandwidth. In the past, manufacturers have relied on proprietary standards as the basis for competitiveness. Full access to the power of the information age demands that shared standards become the norm. The ultimate beneficiaries are the future Small Aircraft Transportation System (SATS) consumers. They will benefit from revolutions in affordability, safety, and ease of use for a new generation of SATS aircraft and airport infrastructure.

What is the Government interest in open standards? Simply stated, open systems greatly facilitate technology transfer and deployment, which are the primary functions of Federal funding for general aviation R&T. The Government role is to stimulate development of high risk technologies that have significant "public good" value. The public good metrics, directed by the Administration and Congress, include safety, mobility, National Airspace System capacity, noise, and emissions. Future NASA investments have far greater impact on these "public good" metrics if the U.S. general aviation industry adopts open standards and architectures. This fact becomes increasingly important to mitigate the effects of declining Federal R&T budgets during the coming years.

Open systems business and engineering strategies are relatively new to the general aviation industry. In the past, companies built their competitive edge on the basis of proprietary standards. In the future, the achievement of the technological and operational features and capabilities needed for a SATS will depend vitally on open systems standards. Over time, the use of proprietary standards will have diminishing value to the speed, quantity, and quality of innovations. To continue the "raised tide" metaphor, we must all raise our anchors, whatever those anchors may be, before the tide runs out.

In summary, AGATE will leave several legacies. The legacy of open systems will pave the way for advancements in affordability, safety, and ease of use for future aircraft. These are advancements that have seemed like "pie-in-the-sky" in the past. The door to open systems leads to the path to more rapid innovations and increased influence of market forces (versus certification or regulatory inhibitors) for new products. Yet, the move by industry toward open systems requires a shared belief that doing so energizes the potential for growth, both in total market as well as in individual market shares. AGATE is built on the foundations of this shared belief.

The AGATE membership has remained steady and the budget continues to be stable. The 1998 partner commitments to date include 36 Principal, 4 Associate, 20 Supporting, and 3 Government Members. These are the partners and programs committed to achieving world class R&T capacity for the U.S. general aviation lightplane industry. □

Aviation Weather Information (AWIN) Program Commences

AGATE Members ARNAV and NavRadio Selected to Develop GA Weather Systems

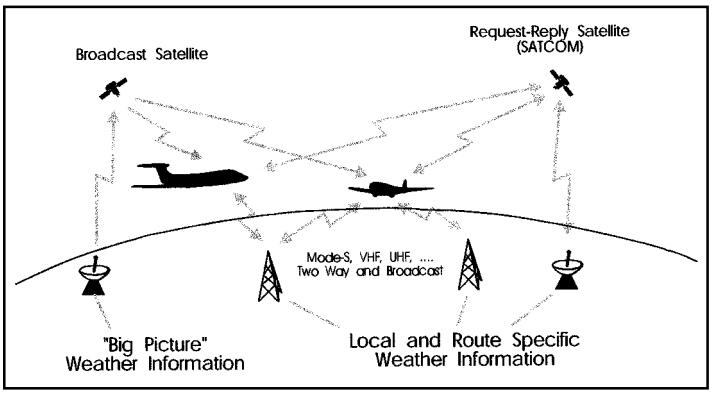
Efforts to provide general aviation (GA) pilots with up-to-date weather information in the cockpit are shifting into high gear under the auspices of the Aviation Weather Information (AWIN) project. AWIN is part of a research and technology program known as Aviation Operations Systems (AOS), which is being led by NASA Ames Research Center. The parent AWIN project, directed by officials at the NASA Langley Research Center, features three sub-elements: AWIN, turbulence, and communications.

"The main focus of AWIN is to take existing weather information that is available and provide a means to get it in an accurate and timely manner to the flight deck, to air traffic control, and to airline operation centers—for GA, maybe a private aircraft operation organization or fixed base operator (FBO) such that you would be able to do collaborative decision-making. That is, the air traffic controller and the flight deck, and some other party involved would be able to jointly and very quickly, using the same information, make a decision beneficial to the overall traffic flow, efficiency, and safety," said Paul Stough, AWIN Level Three Manager.

There are three major areas of emphasis in AWIN. The first area concerns Enhanced Weather Products. "This is where you take existing weather products and reformat them or combine several products into a new product that presents the information that is really needed. Another part of providing enhanced weather products is weather hazard detection. This involves determining what kind of on-board sensors are required so that they can become more effective parts of hazard detection systems. One activity we are looking at is taking existing radars that are on airplanes and enhancing them so that they can better detect turbulence. The idea of Electronic Pilot Reports (EPIREP) would fall under this category as an enhancement to the ability to detect weather hazards," said Stough.

The second major area of emphasis in AWIN is Data Communication/Link. According to Stough, this involves "looking at the system architecture such that you can connect together the airplanes and the ground, and pass the information back and forth on the ground and in the air in a timely manner and do it accurately and affordably."

The third major area of emphasis in AWIN is Operator Support. As stated by Stough, "This encompasses how you present the information. Display is certainly a large part of this, but there may be other appropriate interfaces such as a tactile or oral annunciator for certain things that would be part of the presentation system. The other part of operator support is decision-making. This involves determining what we can do to take the weather information and help the crew, or the controller, or airline operation center make the right decision. Ultimately, you want to make a decision that supports a safe action," said Stough.



graphic courtesy of Dr. Charles Scanlon, NASA Langley Research Center

AWIN Technology Systems

AWIN efforts began last December, when NASA circulated a research announcement that solicited proposals for aviation weather information systems or elements of such systems. "We targeted selections for two of the proposals for transport world-wide systems and two for GA. One of the GA teams selected is headed by ARNAV and the other is headed by NavRadio, both of which have been active members in the AGATE Flight Systems Work Package. A proposal submitted by NavRadio to develop a system for EPIREPs was also selected. This activity is being performed through the Flight Systems Work Package in AGATE, and started back in July," said Stough.

ARNAV and its team members are concentrating their AWIN efforts on the development of an advanced weather hazard information system designed to reduce GA fatal weather-related accidents. This system will integrate the use of advanced graphical weather displays among GA pilots and entail the connection of the existing ARNAV datalink infrastructure and WxLink services, a vast network of 57 ground stations located throughout the United States, to the National Center for Atmospheric Research (NCAR). The team will provide more than 400 hours of in-flight evaluation on four advanced weather products presently being developed by NCAR. "The AWIN program allows us to develop more advanced weather products by using the expertise of NCAR, and sending the new weather products via the ARNAV ground communications network. The other team members (Cessna, NCAR, SAMA, and EAA) provide an unparalleled evaluation team to facilitate the rapid deployment and certification of weather products that will provide a much higher level of safety," said Frank Williams, President of ARNAV Systems Inc.

NavRadio leads two AWIN projects. The company and its team have been selected to deploy and operate a fully functional "weather in the cockpit" system via VHF broadcast datalink, and to conduct topical research into practical EPIREP systems. The broadcast datalink system encompasses ground

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U.S. Air Force Research Laboratory Hosts AGATE Alliance Executive Council Meeting

The AGATE Executive Council held a meeting at Wright-Patterson Air Force Base June 23-24. The meeting was preceeded by an in-depth tour of the National Center for Composite System Technology facility located just outside the Air Force Base. The tour provided an excellent demonstration of public-private technology commercialization. The facility provides state-of-the-art prototyping for large composite structures. An ongoing project for the automotive industry was demonstrated that produces a structural composite pick-up truck bed.

The Executive Council had a full agenda that addressed items ranging from approval of the individual work package research plans and budgets to establishing guidelines for new member acceptance. Individual work package leaders presented their Technical Councils plans and budgets, and action items were referred to the General Aviation Program Office (GAPO) for resolution. The host for the meeting, Dr. Lanny Jines, chief of Air Force Research Laboratory (AFRL) Corporate Communications, provided an excellent venue in an environment surrounded by aviation history. "We were delighted and honored to host the latest Executive Council meeting here at the AFRL's Ohio headquarters. . .The synergy of these face-to-face meetings is outstanding," said Dr. Jines. A break for dinner provided an opportunity for a great meal in the hotel that was host to the historic Dayton Peace Accords conference. After the somewhat controversial budget session, peace accords seemed to be in order. The evening session dealt with various issue papers and lasted late into the night. The meeting concluded the following day with very active participation of the council observing members. The General Aviation Manufacturers Association (GAMA) took the opportunity to take an active role in support of the Flight Training Curriculum Work Package.

The day following the Executive Council meeting provided an opportunity for Dr. Bruce Holmes to present the National Roadmap Strategy for the Small Aircraft Transportation System (SATS) to over 200 industry representatives in the auditorium of the U.S. Air Force museum. The gathering of the AGATE members and other industry representatives was a pioneering endeavor in its own right on our quest for the "Highways in the Sky." □

Integrated Design and Manufacturing Work Package Votes Unanimously to Admit Material Manufacturers

Seven Companies to Become AGATE Members

A group of AGATE organizations working on new materials testing have made significant breakthroughs that have been recognized by the FAA and attracted seven companies to seek membership in the Alliance, beginning with the 1999 project year. The new members, all materials suppliers, are seeking participation in the Alliance to conform their materials testing to the new AGATE standards. The companies will join in a category designed specifically for suppliers. The Integrated Design and Manufacturing (ID&M) Technical Council reviewed and agreed to the new members during its business meeting the week of August 17, in Hampton, Virginia, held at the offices of the private sector members technology development association, the AGATE Alliance Association, Inc. (AAAI).

The seven companies seeking participation in the Alliance under the ID&M Work Package include FiberCote, Inc.; 3M; Newport Adhesives & Composites; Toray America Composites; Shell; Foster-Miller; and A&P Technology. These companies manufacture and supply advanced composite materials used for structural aircraft components.

The invitation for the companies to join the work package was made by the Principal members of the work package. "This decision was made based upon the growing importance of providing the GA airframe companies with FAA approved material design properties and to alleviate the need for each individual company to generate or qualify the material independently," said Dr. John Tomblin, Task Leader for the AGATE Materials Work Group. "The materials suppliers will be providing important data to AGATE that, hopefully, the airframers can use to minimize their materials qualification costs on future programs," added Tom Freeman, ID&M Work Package Leader.

The seven new materials members will be joining the Alliance next month as Supporting members. This requires them to meet just two terms: the ability to demonstrate a capacity to contribute technically to the AGATE goals, and payment of member dues.

The ID&M Technical Council also approved Scaled Technology Works as a Principal member. New Principal members are required to meet three conditions: demonstration of a capacity to contribute technically via assignment of a technical task; provision of resources to match Government funding for the task, payment of a fee for past deliverables, and dues; and demonstration of capacity to commercialize the results of their assigned task work. Organizations seeking additional information about AGATE membership are directed to the AGATE Alliance Association, Inc. Also, the Alliance maintains a business operating handbook, which contains a section specifying the steps for application to AGATE membership. □

AirVenture '98

A record 855,000 people attended this year's Experimental Aircraft Association Convention, known as AirVenture '98, at Oshkosh, Wisconsin. The expansion of the general aviation (GA) industry served as a major theme at this year's exhibition and was evidenced through numerous aircraft manufacturer and aircraft static displays.

The main AGATE display at the Convention was the AGATE-1B testbed aircraft. This aircraft, a Raytheon Bonanza, is used by AGATE Alliance members to flight test AGATE-developed technologies.

NASA Administrator Daniel S. Goldin visited AirVenture '98 and had productive interactions with a variety of GA industry representatives, AGATE members, and state aviation officials. He emphasized that his 21st Century vision for NASA was to see a successful Mars landing and a national small airplane transportation system.

Several NASA Small Business Innovation Research (SBIR) and Small Business Technology Transfer Research (STTR) Program exhibits were featured. These included an SBIR exhibit by AvroTec highlighting its development of an innovative integrated cockpit display system for small aircraft. The low cost AvroTec display will utilize a computerized monitoring system that significantly reduces pilot workload and provides access to ATC datalink, traffic control information, and graphical real-time weather information.

In an STTR exhibit, Mod Works displayed its proposed low cost retrofit process for integration of avionics and cockpit sub-systems into GA aircraft. The process involves the use of computer aided design, CNC machining, robotics, connectors, wire, composite materials, and low cost labor practices. Mod Works' STTR partner, Mississippi State University, developed the direct female molding making manufacturing method for the project.

In another STTR exhibit, Wiesen Engine displayed a prototype of a lightweight inexpensive aircraft diesel engine. The engine is also being marketed in the marine world. Plans are being made to test the prototype in test facilities of the U.S. Merchant Marine Academy, an STTR partner to Wiesen.

Lightning Technologies highlighted their GA lightning protection achievements in their SBIR exhibit. The exhibit discussed lightning safety design guidelines for protecting digital avionics against HIRF and atmospheric lightning effects.

Cox & Company, Inc. and Innovative Dynamics, Inc. described their Electro-mechanical Expulsion Deicing System (EMEDS) in an SBIR exhibit. EMEDS uses expulsion deicing in combination with conventional electro-thermal anti-icing to protect GA aircraft from ice buildup. Other SBIR exhibits highlighted Global's Quasi-Constant Speed Composite Propeller development efforts and Aurora Flight Sciences' Single-Lever Power Control for GA aircraft.

Heading the list of futuristic GA aircraft on display were VisionAire's VA-12B Spirit jet-powered aircraft and the CarterCopters Gyroplane. The CarterCopters Gyroplane design combines autogyro and airplane operations. CarterCopters performance targets are operating altitudes up to 45,000 feet and cruise speeds of over 300 mph, while retaining very short field take-off and landing capability. Development of the Gyroplane is being funded by NASA Ames Research Center under the SBIR program.

The Cirrus SR20 and Lancair Columbia 300 aircraft were popular AirVenture '98 attractions. Both airplanes are AGATE-type airplanes and are meant to appeal to existing and emerging customers looking for high performance and comfortable personal small airplanes. Both airplanes use technologies ranging from composite aircraft materials to single-lever power controls and advanced cockpit displays.

AirVenture '98 also marked the debut of "Aladdin," a jet-powered, radio-controlled model of an advanced GA aircraft design developed by engineering students at four Kansas universities. The team won funding to develop the model through the National General Aviation Design Competition which is sponsored by NASA and the FAA. The design was developed under a new award category—Design-It, Build-It, Fly-It—which is co-sponsored by the Experimental Aircraft Association (EAA). The category allows students to take a well-evolved design to a proof of concept phase. □

photo courtesy of Lancair International

The AvroTec Innovative Integrated Cockpit Display System as applied to the Lancair Columbia 300.

photo courtesy of CarterCopters

The CarterCopters Gyroplane.

Message from the Director of the AGATE Alliance Association, Inc.

Jack Sheehan

The AGATE Alliance Association Inc. (AAAI) continues to mature as an organization with the mission to support the development of technology necessary for the revitalization of the general aviation industry. AAAI is also performing research in the field of public-private consortium management. An alliance as large as AGATE provides many unique management challenges on both the government side and the private side.

The formation of AAAI as a non-profit 501 (c)(3) was an industry recognition that the Research and Technology (R&T) issues needed a focal point and that research support for program management activities could better be accomplished by a dedicated industry organization. The challenges at AAAI range from proprietary intellectual property issues to the logistics of a work package meeting. Communications is one of those enabling functions that always needs attention. From publishing the internal and external newsletters, to operation of both the open and secure Internet servers, AAAI is very busy communicating. The electronic registration for our Plenary meeting and Technical Council sessions in Kissimmee, Florida after the Lakeland Airshow made life easier on everybody and helped reduce costs. The event was the most successful session to date. Since then, we have held technical councils at AAAI and provided some excellent support by facilitating very difficult issues.

The role of AAAI has changed as responsibilities have gradually shifted from the public sector to the private sector. Industry, represented by the Executive Council, has recognized the need to be more active in the technical management of the Alliance. As such, AAAI will perform some functions normally associated with a chief engineer in a company. These functions, such as critical path analysis and design reviews, will be performed for the Alliance by AAAI. We will contract for services utilizing the broad talent base of the members. This is a great example of the collaborative strength in numbers. We have also presented a plan for a more streamlined acquisition process by reducing the number of NCA's and utilizing AAAI as a prime contractor for each work package, providing advance payments and reducing the administrative workload.

In our endeavors to pursue research in public private alliances, Paul Masson of PMC Consulting is still very active working for AAAI. As you will recall, Paul provided some excellent background work on the performance of companies engaged in alliances (AGATE Flier, March 98). I have asked Paul to work on commercialization data for a qualitative report specific to AGATE, in order to generate some inference concerning the value of the Alliance. Ultimately, the success of AGATE will be judged on technical achievements, but I often hear senior personnel in member companies stating that the collaborative effort has done more than it is being given credit for. We are going to try and measure that element of AGATE and produce a report that supports the use of such alliances. □

New Training Courses

(continued from page 1)

students time to repeat and reinforce needed skills more often than in the past," said Dr. Hampton. Another key element is the delay of solo activities until late in training. "This reduces the pressures of performing solo type skills, aids in confidence building, and allows additional skills to be taught prior to solo. The result is a better prepared solo pilot with additional skills. Solo is scheduled at about 26 hours of flight time, against the traditional 10-14 hours. The national average is somewhere around 18 hours," he said.

Embry-Riddle has invested heavily in the Flight Training Curricula Program. The University has dedicated ten new C-172s to training the Flight Training Curricula students. Ground training for the Unified Curriculum is being enhanced through the use of Personal Computer Aviation Training Devices (PCATD). "Embry-Riddle's involvement with the AGATE project has benefited the university in several ways. The program has helped us establish new relationships and strengthen existing bonds with aviation industry leaders and has given us an opportunity to work with NASA Langley's General Aviation Program. Our students will benefit from the cutting-edge technology and training that we are incorporating into the curriculum and our association with AGATE reinforces our reputation as the world's leader in aviation/aerospace education," said Dr. Steven M. Sliwa, President of Embry-Riddle Aeronautical University.

"The AGATE Flight Training Curricula Program is the largest single research project that we have had at Embry-Riddle. Our success in this program is a clear demonstration that Embry-Riddle has become a mature research organization. Embry-Riddle is the only non-government organization that has the responsibility for leading one of the AGATE work packages. Our successful management of the Training Work Package is showing the world that even though we are a small university and a relative newcomer to the research community, we have reached a maturity that is generally only associated with large research institutions with many decades of research experience. I am convinced that the type of university, industry, and government partnership that we have established to carry out the Training Curricula Program is a model for successful research partnerships in the next decade," said Dr. Andres Zellweger, Dean of Graduate Programs and Research at Embry-Riddle Aeronautical University.

Eighty-one students volunteered, at their own expense, to participate in the program for a one step Private/Instrument certificate. The students are currently completing the final phases of flight training. "We were hoping that all the students would have completed their training courses by the end of July; however, uncharacteristic weather conditions and the fires in the Daytona Beach area have caused delays in training of one-and-a-half to two months. We still anticipate that the majority of the students will be completed by the end of August. One student, Algeria Morse, has successfully completed the Unified Curriculum, and we anticipate more shortly. As in all training, there are those that are more motivated and have better learning skills than

others. As a result, the students will not be completing the program all at the same time," said Dr. Hampton.

"Students seem to excel faster through the advanced instrument phases of training (like approaches and holding) rather than the private phases. The private training causes the most difficulty, because it is where the students learn to actually fly the aircraft (takeoff, climb, straight and level; do turns, descents, landings, etc.). Once this initial training is accomplished, the flight course flows a lot smoother," said Jesse Rhodes (ERAU), AGATE Flight Training Curricula Program Flight Instructor.

Algeria Morse's completion of the Unified Curriculum represents the first step toward achieving a dream. She plans to major in Aerospace or Aeronautical Engineering at the United States Naval Academy and would like to become a Naval Aviator. "My ultimate goal is to become an astronaut for NASA," she said.

The national average for receiving a basic private pilot license is approximately 72 hours of in-flight training over nine months. This is followed by instrument training of 104 hours over an additional nine months. Morse completed the equivalent training with a 29 percent savings in ground and flight training, a 20 percent savings in cost ($4,000) and an 83 percent savings in total elapsed time. "Flying is the thrill of my life. The AGATE training was intense indeed, yet I strongly believe that my love for aviation is what guided me to success. I must also give credit to my flight instructor, Jesse Rhodes, who is a very motivated individual. His love for aviation played a tremendous part in my success. While the training was intense, I was still able to maintain a full-time status and a 4.0 GPA at ERAU. I say this because I would like to encourage those who want to participate in the AGATE Flight Training Curricula Program but may think that they will not have enough time to dedicate to the program. I feel anyone can accomplish this task if they truly have a love for aviation," said Morse.

Morse anticipates that her flight training experience in the AGATE Flight Training Curricula Program will help greatly in her future piloting endeavors. "Because of the intensity of my initial flight training, I feel that I am prepared to take on the challenge of future pilot certifications. Although my training took only 3.5 months, I believe that the incorporation of Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) reinforced many important concepts that may not have been reinforced in the normal pilot training. Unlike the traditional training, in the dual program, learning both VFR and IFR is a part of daily routine. As a result of this format, I studied concepts in the private pilot manual and then had them repeated in the same session when studying the instrument manual. In my opinion, this was positive reinforcement. Learning IFR at an early stage helps to build confidence that the average new student pilot does not have because of fear or ignorance of what the instruments really are. Confidence is always important when controlling an aircraft," she said.

The FAA is also playing a key role in the Flight Training Curricula Program. "The FAA's role is to advise the Flight Training Curriculum Work Group on regulatory requirements and FAA policy, assist in the facilitation of the Flight Training Curricula, be the FAA representative on the team, and coordinate with AGATE management," said Tom Glista (FAA), Acting Flight Training Curriculum Work Package Leader. The FAA is facilitating progress within the curricula program by "ensuring that the level of safety is not reduced; advising the work group members of FAA policy and procedures; and working with FAA management to change policies, procedures, and rules, as necessary, to attempt to implement AGATE," he said.

The Flight Training Curricula Program holds numerous benefits for those who want to learn how to fly in an advanced GA aircraft. "Reduced cost and an easier, more interactive learning experience, especially during ground school, are among the main benefits," said Dr. Hampton. "The goal is to have a fully interactive experience for those students seeking Private/ Instrument certification."

In the near future, Flight Training Curricula Program planners plan to integrate AGATE specific systems into the curricula. These systems include single lever power control, AGATE flight displays, and ice protection devices. The introduction of these new technologies is expected to have a dramatic effect on the ability of students to fly an advanced GA aircraft. "The number one issue constantly related to training and safety is situational awareness. Use of moving map displays and presentation of weather information will contribute greatly to the safety of flight and the ability of pilots to maintain situational awareness. Decision-making aids will also greatly enhance the pilot's ability to make correct decisions in critical situations," said Dr. Hampton.

"This past year, we have been looking at new training technology, especially PC air crew training devices and have conducted research on training for single lever power control and for the AGATE integrated cockpit information system. This coming year, we will integrate what we have learned about training for the AGATE cockpit technologies into the combined curriculum and begin evaluation of it using the AGATE Simulation Training Testbed at Embry-Riddle. It is our hope that this will lead to some real advances in understanding how to best train pilots to fly AGATE airplanes in a Free Flight environment," said Dr. Zellweger. □

Schedule of Events

October 21–22, 1998:
Palm Springs, CA
Flight Systems Technical Council Meeting

October 23–25, 1998:
Palm Springs, CA
AOPA EXPO '98

February 2–3, 1999:
Washington D.C.
National Research Council –Transportation Research Board SATS Workshop

TBD, 1999:
Atlantic City, NJ
FAA Tech Center
Conference of Technical Councils

Virginia Tech Team Wins 1997-98 General Aviation Design Competition

Futuristic design concepts and tools captured the imaginations of those judging the fourth annual National General Aviation Design Competition. Winners of the competition were announced by NASA and the FAA at AirVenture '98.

The 1997-1998 first place award was presented to a 27-member undergraduate team from **Virginia Tech**. Their winning design, dubbed "VicTor," is a single-engine, four seat, high performance aircraft. The team's broad goal was "a fun-to-fly, safe, affordable aircraft prepared to fly on the 'highway in the sky' of the twenty-first century." The sleek airframe design features an ergonomic cockpit with adjustable side control sticks and dual airbags, a choice between two high performance engines, and advanced technology instrument displays. The design looks to the next century by providing an upgrade option to allow autonomous flight if it becomes a reality. The VicTor incorporates state-of-the-art manufacturing techniques and advanced composite materials. The first place award provides a total of $3,000 to design team members and a $5,000 award to the university's Department of Mechanical, Nuclear, and Aerospace Engineering.

The team also won a separate $3,000 award for the best use of technology developed by the Air Force Research Laboratory. The team incorporated Air Force data on pilot anatomy to create an innovative fully ergonomic cockpit. The students also used the United States Air Force Data Compendium handbook in their research. Aircraft navigation for the VicTor design is largely dependent on the Global Positioning System, jointly developed by Air Force and other Defense Department organizations for military and civilian users.

Second place honors went to **Pennsylvania State University** for "Skipper 2," a high performance, two person single-engine, composite fuselage, tractor-prop light airplane. The low wing design features a high power engine and retractable landing gear. Other hallmarks are a user-friendly, multifunctional display cockpit, good stall characteristics, and structural simplification for ease of manufacturing. To enhance all-weather capability, the design also features a weeping wing de-icing system. Crashworthiness was also a major consideration. The team offered design variations for four-place, trainer, and acrobatic versions of their aircraft. The design was developed by a 15-student team as part of a senior level design course. The second place award provides a prize of $2,000 to the student team.

Third place was awarded to a team of 13 undergraduate students from the **University of Virginia**. For third place, the student team will share a $1,000 prize. The team was honored for developing a computer program that predicts drag, or resistance to air flow, in the design of new small passenger airplanes. One of the things that slows the development of new aircraft is the need for extensive flight testing of a prototype to determine the drag factors. The UVA team recognized that a computer program that could do much of the drag prediction in the design phase would save time and money in the development of new and modified airplanes, speeding effective new designs to the marketplace.

The competition is managed for NASA and the FAA by the Virginia Space Grant Consortium. Guidelines are now available for the fifth annual competition to be held during the 1998-99 academic year. New criteria encourage both individual and team submissions, and designs ranging from components and subsystems to complete aircraft designs. Guidelines can be requested at 757/865-0726 or mls@penngrad.pgtt.odu.edu. □

photo courtesy of Donna Bushman

***Virginia Tech won first place in the 1997-1998 National General Aviation Design Competition. Pictured are:** (Front Row, L-R) Students-Phillip Vallance, John Fussell, Joseph Honaker, Chuck Boyer; (Middle Row, L-R) Students- Kristin Burke, Derrick Radtke, John Helmantoler, Adam Olsen; (Back Row, L-R) Students- Jana Schwartz, Kristin Makovec, Steve Penn; Michael Mann-NASA Deputy Associate Administrator for Aeronautics and Space Transportation Technology; Bruce Holmes-NASA Langley General Aviation Program Office Director; Ann Harlan-FAA William J. Hughes Technical Center Director; Jim Marchman-Project Faculty Advisor and Design Professor; Dennis Carter-Competition Judge, Air Force Research Laboratory, Wright Patterson AFB.*

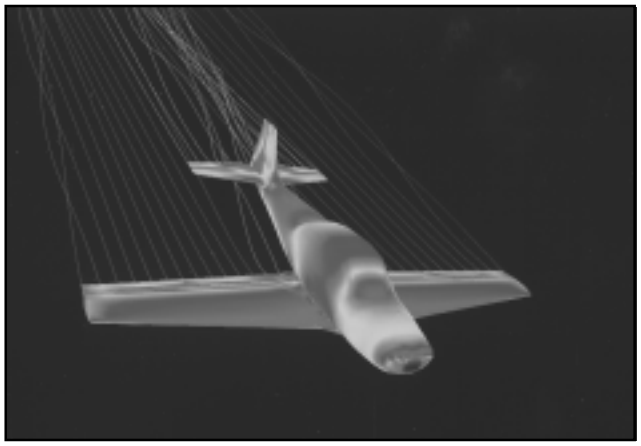

photo courtesy of University of Virginia

The University of Virginia took third place in the 1997-1998 National General Aviation Design Competition for developing a computer program that predicts drag. This computer image depicts differences in air pressure acting on a general aviation airplane.

Management and Technical Progress Highlights

Integrated Design and Manufacturing

The Integrated Design and Manufacturing (ID&M) Work Package reported that FAA conformance qualification is proceeding with Cessna material (Fiberite 7740) with three Carbon fiber forms—unidirectional tape, plain weave, and eight harness satin weave. These materials are autoclave processed at 40 psi and 250 deg. cure. Materials equivalence testing began in late August.

Simula reported that a review of the Design Guide section drafts is continuing. The review of the restraint system section was completed in June and the revision of that section is underway. Review of the seat section was completed in July followed by a review of the remaining sections (anthropometry, airframe structural crash resistance, and interior delethalization). The human tolerance section is presently undergoing review and revision. The main focus of the review and revision process is to reorganize the drafts (which are based on the U.S. Army Aircraft Crash Survival Design Guide) so the information is easier to find and to include more recent crashworthiness research from AGATE and other sources. The "Reference System A" draft of the Design Guide will be complete by the end of the summer.

The Work Package reported that six more indoor drop tower tests (12 cushion tests) were performed at the Simula Technologies Dynamic Test Facility. These tests were conducted on twin rigid seat fixtures (with two dummies) to the FAR 23.562(b)(1) vertical test condition (19 G, 50 ms rise, 31 feet/sec delta V, 30-degree nose down). Terence Lim at Cessna is analyzing the test data. More cushion drop tests have been planned for late summer.

Ice Protection Systems

The University of Illinois completed their wind tunnel testing in June. A final report was completed in August.

Integration Platforms

The Integration Platforms Work Package reported that control system modifications to the F-33C Bonanza (AGATE-1B) aircraft have been completed at Raytheon. The computers have also been upgraded to support the "Highway in the Sky" software.

The Work Package also reported that AGATE is working with the Aviation Weather Information (AWIN) program to identify both ground sites and candidate airplanes that are suitable to expedite flight testing of an affordable Flight Information Services (FIS) system, which would be of benefit to both programs. This comes as a result of AWIN finalizing a Cooperative Research Agreement (CRA) with the NavRadio Corporation regarding the development and implementation of a general aviation oriented VDL-based FIS broadcast, reception, and display system.

Flight Training Curriculum

A Web Site has been completed for the Flight Training Curriculum Work Package. The site can be found as a link off the AGATE home page. As part of the Web Site, a questionnaire is being developed to generate public opinion on Flight Training activities.

Validation of the first Basic Curriculum is in progress, the ground school has been completed, and the students are flying. Students are now completing flight training.

Validation of the Unified Curriculum is in progress. One student has already been completed and others are close.

Program Analysis

The Program Analysis Work Package reported that 4,927 users have been on the program analysis Internet site. These visitors have spent an average of 5:39 minutes exploring the site and have accessed 27,517 page views for an average of approximately 6 page views per visitor.

The visitors have completed 413 surveys and 100 of the survey respondents have requested more information on either learning how to fly or on purchasing an airplane.

The Work Package reported that the number of identifiable International Users who visit the site remained relatively constant at 14 percent of the total traffic. The number of United States visitors is 49 percent with 37 percent of the visitors not identified.

AGATE ALLIANCE MEMBERSHIP

Work Packages: Flight Systems (FS)
Propulsion Sensors & Controls (PS&C)
Integrated Design & Manuufacturing (ID&M)
Ice Protection Systems (IPS)
AGATE Integration Platforms (AIP)
Flight Training Curricula (FTC)
Systems Assurance (SA)
Program Management (PM)

Work Package Membership: P = Principal; A = Associate

Official Organization Name	FS WP-1	PS&C WP-2	ID&M WP-3	IPS WP-4	AIP WP-5	FTC WP-6	SA WP-11	PM WP-12
Advanced Creations Incorporated						P		P
Airborne Research Associates	A							
Allied Signal Aerospace Company	P		P					
ARINC Incorporated	P							
ARNAV Systems Incorporated	P							
Aurora Flight Sciences		P						
AvroTec Incorporated	P						P	P
BFGoodrich Aerospace				P				
Cessna Aircraft Company	P	P	P	P	P	P		P
Cirrus Design Corporation	P	P	P	P			P	
Cox and Company Incorporated				P				
Digital Equipment Corp.	P							
Embry-Riddle Aeronautical Univ.			P			P	P	
Florida Institute of Technology						P		
Global Aircraft Corp.			P			P	P	
Harris Corporation	P							
Hartzell Propeller Company			P					
Honeywell Technology Center		P						
Innovative Dynamics Incorporated				P				
Jeppesen Sanderson Incorporated	P					P		
Kestrel Aircraft Company			P					
Lancair International Incorporated			P					
McCauley Propeller Systems			P					
Mod Works Incorporated			P					
NavRadio Corporation	P							
Ohio State University				P		P		
Raytheon Aircraft Company	P	P	P	P	P	P	P	P
Raytheon E-Systems	P	P					P	
Rockwell Collins Incorporated	P						P	
Ross Engineering	P	P						
Seagull Technology Incorporated	P							
Simula Technologies Incorporated			P					
Stoddard-Hamilton Aircraft Incorporated			P					
Teledyne Continental Motors		P						P
Textron Lycoming		P						
Trimble Navigation Limited	P							
Unison Industries		P						
United Technologies Hamilton Standard			P	P			P	
Wichita State University-NIAR			A	A			A	A

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General Aviation Manufacturers Association (GAMA)
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New Piper Aircraft Incorporated
Optimal Solutions Incorporated
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Small Aircraft Manufacturing Association (SAMA)
II Morrow Incorporated
University of Illinois at Urbana-Champaign
University of Kansas
University of Tennessee Space Institute
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Wyndemere Incorporated

GOVERNMENT PARTNERS

Federal Aviation Administration
NASA Langley Research Center
NASA Lewis Research Center
USAF Research Laboratories (Wright Directorate)

AWIN

(continued from page 3)

infrastructure, weather data acquisition and delivery, low-latency information delivery via datalink, and display of the weather in the cockpit. NavRadio will produce a system of "Open Architecture" technology that conforms to the new VDL Mode 2 international datalink standard. "That means that the datalink technology that we are using is the same technology that has been selected for DGPS approach correction data, ARINC's next-generation airline datalink, and future FAA digital air traffic communications, and is already being implemented internationally for ground-to-air datalink," said Brian Haynes, Vice President of NavRadio. "NavRadio made the first public demonstration of VDL Mode 2 technology for small aircraft two years ago in conjunction with AGATE; today the AGATE-1B aircraft includes NavRadio's VDL-based weather datalink as a baseline capability. Now, through AWIN, those ground-breaking developments will be taken to the implementation phase over a regional area and multiple aircraft."

On the cockpit side, NavRadio's team will focus on "Open Architecture" once more. The datalink radio receiver will be compatible with multiple displays from lap-top/palm-top computers, through portable flight computers like the AvroTec Flight Monitor, to panel-mounted Multi-function Displays (MFDs) like the model 5RR from team member Avidyne Corporation. "Our goal is to be conservative of valuable panel space, by providing a blind-mounted radio and the option to choose from a variety of display types," said Don Moore, President of NavRadio, who uses the datalink for test purposes in his Beech Baron with a palm-top display. "The palm-top display works well as a starting point. I see the lap-top option as a way for aircraft owners to try their hand at datalink with the least amount of investment, and move up to permanent avionics over time." With NavRadio's program, the choice of display is up to each individual aircraft owner.

To realize the ultimate goal of AWIN, significantly reducing aviation weather related fatalities, NavRadio will provide high quality, real-time, easy to read data, both in graphical and textual formats, to pilots operating aircraft that traditionally have not been equipped with any weather avoidance information systems besides voice communications with FSS. Also, these aircraft most frequently operate at low altitudes where significant weather phenomena are present.

NavRadio's second AWIN project features a team that will deploy, operate, and evaluate automatic electronic pilot reporting (EPIREP) for GA aircraft. The total package includes onboard sensor technologies, air-to-ground datalink, and ground infrastructure capable of routing the data to NCAR for new weather modeling and product generation. Also, the information can be re-distributed via datalink after it has been collected, sorted, and used to produce new weather products. This program is focused on GA including regional airlines, as they generally fly "down in the weather" as well.

As with the data broadcast system project, the EPIREP project facilitates the goals of both AWIN and AGATE. In recognition of that common interest, the AWIN Program Office and the AGATE Alliance have agreed to pursue the EPIREP project jointly, giving both groups access to the results achieved.

In conjunction with AGATE, NavRadio and several other AWIN team members have flight tested many key technologies to be used in the AWIN projects, particularly in the AGATE-1A and AGATE-1B aircraft. The EPIREP technology is a new development that will be tested in part in conjunction with the AGATE-1B program.

Beginning in the fiscal year 2000, the AWIN activity will still be known as AWIN, but it will be transitioned over to NASA's Aviation Safety Program (AvSP). NASA plans on spending $60 million (gross) over a period of seven years on AWIN.

In the future, AWIN participants will be developing and fielding prototype AWIN technology systems. "This will help to better develop the technologies and also provide some seed money for the start-up of such systems," said Stough. "We intend to be working with AGATE and the Aviation Systems Capacity program as much as we can to make sure that we are not duplicating efforts and that we are working toward common goals. We will also be working with the FAA and NCAR," he said. More information on the AWIN program can be found at the following AWIN website: http://zethus.larc.nasa.gov/~jayr/webpages/awin/index.htm. □

Plans Set for Datalink Infrastructure Facility

Activities in AGATE have progressed to a stage where a ground infrastructure is needed to conduct comprehensive in-flight evaluations of developing products and related avionics, and to acquire baseline and long-term data necessary for defining guidelines, standards, and certification methods (GS&Cs) for such new products. It is anticipated that other government and standards setting organizations will have similar requirements for testing datalink products and services, and developing procedures and certification policies associated with incorporating advanced concepts into the airspace system. Accordingly, AGATE has initiated an effort to deploy—over a limited area—the needed ground infrastructure in which to evaluate these systems, which had been referred to as the National Airspace System Datalink Infrastructure Facility (NASDIF), but is now simply identified as the Datalink Infrastructure Facility (DIF).

To date, no facility exists capable of providing the necessary infrastructure to support data acquisition for certification in prototype and human factors studies to bring new products to market. By setting the cornerstone for a DIF—with a first ground station at the NASA Langley Research Center—AGATE has taken the lead to establish the needed environment, and will work in concert with the FAA and other organizations in further developmental activities.

Services supported by AGATE at the NASA Langley ground station will include: Flight Information Services—Broadcast via VDL Mode 2 Broadcast Datalink, CPDLC and digital voice via VDL Mode 2 and Mode 3 two-way datalink, ADS-B via 1090 Mhz squitter, and "low cost" Differential GPS using VDL Mode 3 datalink.

An evaluation facility in the East Coast region was selected by AGATE in order to incorporate two major NASA facilities, planned FAA projects, via the FAA Technical Center, and state interest as expressed by the Commonwealth of Virginia. Future expansion is planned to provide continuous signal coverage between Langley and the NASA Wallops Flight Test Facility with eventual additional ground stations at the FAA Technical Center, and other sites, as locations and funding sources are identified.

The AGATE Flier

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